

AMENDMENTS TO THE CLAIMS

The following Listing of Claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claim 1 (currently amended): A hydraulic cement based on calcium phosphate for surgical use comprising:

- A) a first component comprising powder particles of calcium phosphate; and
- B) a second component comprising water, wherein:

 - C) said calcium phosphate comprises anhydrous, amorphous calcium phosphate (ACP);
 - D) said ACP is obtained by milling a calcium phosphate synthesized above 500°C;
 - E) said ACP is able to react with water thereby producing a cement paste that becomes a hardened cement; and
 - F) the specific surface area (SSA) of the powder particles of said first component is in the range of 0.05 to 10.00 m^2/g ; and
 - G) said first component further comprises calcium sulfate dihydrate (CSD) or calcium sulfate hemihydrate (CSH).

Claim 2 (currently amended): A hydraulic cement according to claim 1, wherein said ACP is obtained by milling of one or more substances chosen from the group consisting of:

- a) α -tricalcium phosphate [α -TCP; $\text{Ca}_3(\text{PO}_4)_2$];

- b) β -tricalcium phosphate [$(\beta\text{-TCP}; \text{Ca}_3(\text{PO}_4)_2)$];
- c) oxyapatite [$(\text{OXA}; \text{Ca}_{10}(\text{PO}_4)_6\text{O})$]; and
- d) tetracalciumphosphate [TetCP; $\text{Ca}_4(\text{PO}_4)_2\text{O}$];

in the presence of not more than 20 weight percent of a non-aqueous auxiliary milling liquid compared to 100 weight percent of calcium phosphate.

Claim 3 (currently amended): A hydraulic cement according to claim 2, wherein the auxiliary milling solvent is an alcohol, ~~preferably ethanol, or isopropanol~~.

Claim 4 (currently amended): A hydraulic cement according to claim 1, wherein in addition to said ACP, said cement contains one or several other calcium phosphates selected from the following list group consisting of: monocalcium phosphate (MCP; $\text{Ca}(\text{H}_2\text{PO}_4)_2$); monocalcium phosphate monohydrate (MCPM; $\text{Ca}(\text{H}_2\text{PO}_4)_2\text{H}_2\text{O}$), dicalcium phosphate (DCP; CaHPO_4), dicalcium phosphate dihydrate (DCPD; $\text{CaHPO}_4\text{2H}_2\text{O}$); Octocalcium octacalcium phosphate (OCP; $\text{Ca}_8\text{H}_2(\text{PO}_4)_6\text{.5H}_2\text{O}$); calcium deficient hydroxyapatite (CDHA; $\text{Ca}_9(\text{HPO}_4)(\text{PO}_4)_5\text{OH}$), hydroxyapatite (HA; $\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$), beta-tricalcium phosphate ($\beta\text{-CP}; \text{Ca}_3(\text{PO}_4)_2$), oxyapatite (OXA; $\text{Ca}_{10}(\text{PO}_4)_6\text{O}$), tetracalcium phosphate [TTCP; $\text{Ca}_4(\text{PO}_4)_2\text{O}$] and α -tricalcium phosphate.

Claim 5 (previously presented): A hydraulic cement according to claim 1, wherein the amorphous calcium phosphate (ACP) is present in an amount of at least 50 weight percent of the total first component.

Claim 6 (currently amended): A hydraulic cement according to claim 5, wherein the amorphous calcium phosphate (ACP) is present in an amount of at least 80 weight percent, ~~preferably of at least 90 weight percent~~ of the total first component.

Claim 7 (currently amended): A hydraulic cement according to claim 1, wherein said first component comprises ~~an amount of~~ calcium sulfate dihydrate (CSD).

Claim 8 (previously presented): A hydraulic cement according to claim 7, wherein said hydraulic cement does not contain more calcium sulfate hemihydrate (CSH) than 10% of the total amount of said calcium sulfate dihydrate (CSD).

Claim 9 (currently amended): A hydraulic cement according to claim 1 wherein said first component comprises ~~an amount of~~ calcium sulfate hemihydrate (CSH).

Claim 10 (previously presented): A hydraulic cement according to claim 9, wherein the amount of calcium sulfate hemihydrate (CSH) is lower than 5% of said calcium sulfate dihydrate (CSD).

Claim 11 (currently amended): A hydraulic cement according to claim ~~10~~7, wherein essentially no calcium sulfate hemihydrate (CSH) is detectable in the cement.

Claim 12 (currently amended): A hydraulic cement according to claim 1, wherein the powder particles of said first component have an average diameter less than 20 μm and preferably less than 10 μm .

Claim 13 (previously presented): A hydraulic cement according to claim 1, wherein at least one of the first and second cement components comprises a setting regulator.

Claim 14 (previously presented): A hydraulic cement according to claim 1, wherein at least one of the first and second cement components comprises a setting accelerator.

Claim 15 (previously presented): A hydraulic cement according to claim 14, wherein the first component comprises a setting accelerator.

Claim 16 (previously presented): A hydraulic cement according to claim 14, wherein the setting accelerator is an apatite powder.

Claim 17 (previously presented): A hydraulic cement according to claim 14, wherein the setting accelerator is a calcium-deficient hydroxyapatite or hydroxyapatite powder.

Claim 18 (currently amended): A hydraulic cement according to claim 14, wherein the setting accelerator is a water-soluble calcium salt, ~~preferably calcium chloride~~.

Claim 19 (previously presented): A hydraulic cement according to claim 1, wherein the second component comprises a setting accelerator.

Claim 20 (currently amended): A hydraulic cement according to claim 19, wherein the setting accelerator is a dissolved calcium salt, ~~preferably calcium chloride~~.

Claim 21 (previously presented): A hydraulic cement according to claim 13, wherein the setting regulator is a setting retarder.

Claim 22 (previously presented): A hydraulic cement according to claim 1, wherein the first or second component comprises a setting retarder.

Claim 23 (currently amended): A hydraulic cement according to claim 21, wherein the setting retarder is taken selected from the group consisting of citrate, pyrophosphate, carbonate ~~or~~ and magnesium ions.

Claim 24 (previously presented): A hydraulic cement according to claim 1, wherein the setting time of the cement paste at is comprised between 2 and 15 minutes.

Claim 25 (previously presented): A hydraulic cement according to claim 24, wherein the setting time of the cement paste at 37°C is between 5 and 12 minutes.

Claim 26 (previously presented): A hydraulic cement according to claim 1, wherein the Ca/P molar ratio of the cement paste obtained by mixing said components is larger than 1.5.

Claim 27 (previously presented): A hydraulic cement according to claim 26, wherein the Ca/P molar ratio of the cement paste is equal to 1.667.

Claim 28 (previously presented): A hydraulic cement according to claim 26, wherein the Ca/P molar ratio of the cement paste is larger than 1.667.

Claim 29 (previously presented): A hydraulic cement according to claim 26, wherein the Ca/P molar ratio of the cement paste is equal or larger than 2.0.

Claim 30 (previously presented): A hydraulic cement according to claim 1, wherein at least one of the first and second components contains a radiological contrasting agent.

Claim 31 (previously presented): A hydraulic cement according to claim 30, wherein the radiological contrasting agent is a solid compound.

Claim 32 (currently amended): A hydraulic cement according to claim 31, wherein said solid radiological contrasting agent is present in particle form whereby said particles have a diameter larger than 10 micrometer, ~~more preferably larger than 20 micrometer.~~

Claim 33 (currently amended): A hydraulic cement according to claim 31, wherein the radiological contrasting agent is a metal powder, ~~preferably of tantalum, tungsten or titanium.~~

Claim 34 (currently amended): A hydraulic cement according to claim 31, wherein the radiological contrasting agent is a ceramic powder, ~~preferably barium sulfate or titanium dioxide.~~

Claim 35 (currently amended): A hydraulic cement according to claim 30, wherein the radiological contrasting agent is a liquid compound, ~~preferably an iodine compound.~~

Claim 36 (currently amended): A hydraulic cement according to claim 35, wherein the radiological contrasting agent is an organic iodine compound, ~~preferably iopamidol ($C_{17}H_{22}I_3N_3O_8$), iohexol ($C_{49}H_{26}I_3N_3O_9$), or iotrolan ($C_{37}H_{48}I_6N_6O_{18}$).~~

Claim 37 (previously presented): A hydraulic cement according to claim 1, wherein one of said two components comprises an additive to control the cement rheology.

Claim 38 (previously presented): A hydraulic cement according to claim 37, wherein the second component comprises an additive to control the cement rheology.

Claim 39 (currently amended): A hydraulic cement according to claim 37, wherein the additive used to control the cement rheology is ~~taken selected~~ from the group consisting of ~~polysaccharide derivatives, preferably~~ hyaluronic acid or salt, chondroitin sulfate, dermatan sulfate, heparan sulfate, heparin, dextran, alginate, keratan sulfate, hydroxypropylmethyl cellulose, chitosan, xanthan gum, guar gum, and carrageenan.

Claim 40 (previously presented): A hydraulic cement according to claim 37, wherein the additive used to control the cement rheology is acid and/or one of its salts.

Claims 41-43 (canceled)

Claim 44 (currently amended): A hydraulic cement according to claim 1, wherein the first or second component of the cement may further comprise granules whose diameter are at least two times, ~~preferably at least 10 times~~ larger than the average diameter of said powder particles of said first component.

Claim 45 (previously presented): A hydraulic cement according to claim 44, wherein the granules have an average diameter in the range of 100 to 500 μm .

Claim 46 (currently amended): A hydraulic cement according to claim 44, wherein the granules are made of calcium phosphate, CSH calcium sulfate hemihydrate, CSD calcium sulfate dihydrate, polymer, sodium chloride, bioglass or a sugar, preferably glucose, fructose, and mannose.

Claim 47 (currently amended): A hydraulic cement according to claim 1, wherein one or more of said components comprises pharmaceutical or physiologically active substances, preferably antibiotics, anti-inflammatory drugs, drugs against osteoporosis, anti-cancer drugs, peptides, proton pump inhibitors and proteins such as growth factors.

Claim 48 (currently amended): A hydraulic cement according to claim 1, wherein one of said components comprises a tensio-active agent, preferably taken selected from the group consisting of: docusate sodium ($\text{C}_{20}\text{H}_{37}\text{NaO}_7\text{S}$), sodium lauryl sulfate ($\text{C}_{12}\text{H}_{25}\text{NaO}_4\text{S}$), stearic acid ($\text{C}_{17}\text{H}_{35}\text{COOH}$), alkyldimethyl(phenylmethyl)- ammonium chloride [CAS registry number 8001-54-5], benzethonium chloride ($\text{C}_{27}\text{H}_{42}\text{ClNO}_2$), cetrimide ($\text{C}_{17}\text{H}_{38}\text{BrN}$), glycerin monooleate ($\text{C}_{21}\text{H}_{40}\text{O}_4$), polysorbate 20 ($\text{C}_{58}\text{H}_{114}\text{O}_{26}$), polysorbate 21 ($\text{C}_{26}\text{H}_{50}\text{O}_{10}$), polysorbate 40 ($\text{C}_{62}\text{H}_{122}\text{O}_{26}$), polysorbate 60 ($\text{C}_{64}\text{H}_{126}\text{O}_{26}$), polysorbate 61 ($\text{C}_{32}\text{H}_{62}\text{O}_{10}$), polysorbate 65 ($\text{C}_{100}\text{H}_{194}\text{O}_{28}$), polysorbate 80 ($\text{C}_{64}\text{H}_{124}\text{O}_{26}$), polysorbate 81 ($\text{C}_{34}\text{H}_{64}\text{O}_{11}$), polysorbate 85 ($\text{C}_{100}\text{H}_{188}\text{O}_{28}$), polysorbate 120 ($\text{C}_{64}\text{H}_{126}\text{O}_{26}$), polyvinyl alcohol

((C₂H₄O)_n), sorbitan di-isostearate (C₂₄H₈₀O₇), sorbitan dioleate (C₄₂H₇₆O₇), sorbitan monoisostearate (C₂₄H₄₆O₆), sorbitan monolaurate (C₁₈H₃₄O₆), sorbitan monooleate (C₂₄H₄₄O₆) sorbitan monopalmitate (C₂₂H₄₂O₆), sorbitan monostearate (C₂₄H₄₆O₆), sorbitan sesqui-isostearate (C₃₃H₆₃O_{6.5}), sorbitan sorbitan sesquistearate (C₃₃H₆₃O_{6.5}), sorbitan tri-isostearate (C₃₃H₆₃O_{6.5}), sorbitan sesquioleate (C₃₃H₆₃O_{6.5}), sorbitan sesquistearate (C₃₃H₆₃O_{6.5}), sorbitan tri-isostearate (C₃₃H₆₃O_{6.5}), sorbitan trioleate (C₃₃H₆₃O_{6.5}), sorbitan tristearate (C₃₃H₆₃O_{6.5}), glyceryl monooleate (C₂₁H₄₀O₄), isopropyl myristate (C₁₇H₃₄O₂), isopropyl palmitate (C₁₉H₃₆O₂), lanolin [CAS registry number 8006-54-0], lanolin alcohols [CAS registry number 8027-33-6], hydrous lanolin [CAS registry number 8020-84-6], lecithin [CAS registry number 8002-43-5], medium chain triglycerides (no registry number), monoethanolamine (C₂H₇NO), oleic acid (C₁₇H₃₃COOH), polyethylene glycol monocetyl ether [CAS registry number 9004-95-9], polyethylene glycol monostearyl ether [CAS registry number 9005-00-9], polyethylene glycol monolauryl ether [CAS registry number 9002-92-0], polyethylene monooleyl ether [CAS registry number 9004-98-2], polyethoxylated castor oil [CAS registry number 61791-12-6], polyoxyl 40 stearate (C₉₈H₁₉₆O₄₂), polyoxyl 50 stearate (C₁₁₈H₂₃₆O₅₂), triethanolamine (C₆H₁₅NO₃), anionic emulsifying wax [CAS registry number 8014-38-8], nonionic emulsifying wax [CAS registry number 977069- 99-0], and sodium dodecyl sulfate (NaC₁₂H₂₅SO₄).

Claim 49 (currently amended): A hydraulic cement according to claim 1, wherein the specific surface area (SSA) of the first component is in the range of 1.5 to 3.5 ~~M2/g~~ ^{m²/g}.

Claim 50 (previously presented): A hydraulic cement according to claim 1, wherein the cement viscosity of the cement is larger than 1 Pa-s at a shear rate of 400 s⁻¹, one minute after the start of cement mixing.

Claim 51 (previously presented): A hydraulic cement according to claim 50, wherein the cement viscosity of the cement is larger than 10Pa-s at a shear rate of 400 s⁻¹, one minute after the start of cement mixing.

Claim 52 (previously presented): A hydraulic cement according to claim 51, wherein the cement viscosity of the cement is larger than 100 Pa-s at a shear rate of 400 s⁻¹, one minute after the start of cement mixing.

Claim 53 (currently amended): A hydraulic cement according to claim 52, wherein component "a)" additionally comprises water-soluble phosphate salts and component "b)" comprises a polymer, ~~preferably sodium hyaluronate~~.

Claim 54 (currently amended): A hydraulic cement according to claim 1, wherein the setting time of the mixture of said two components is between 2 to 15 minutes, ~~preferably between 5 and 12 minutes~~.

Claim 55 (currently amended): Use ofA method of using the cement according to claim 1, wherein the mixture of said two components is injected into an animal or human bone defect and set in vivo to reinforce the bone.

Claim 56 (previously presented): A method for producing a matrix of apatite as temporary bone replacement material, wherein said two components according to claim 1 are mixed together and allowed to harden.

Claim 57 (currently amended): ~~Temporary~~A temporary bone replacement material obtained by the method according to claim 56, wherein the replacement material comprises an apatite.

Claim 58 (currently amended): ~~Temporary~~The temporary bone replacement material according to claim 57, wherein the replacement material comprises CSD embedded in said apatite matrix.

Claim 59 (currently amended): ~~Granules~~A granule or blocks block obtained by hardening the cement according to claim 1 for in vivo implants.